

The following data was obtained with the apparatus as shown in Fig. 1.2.

$\rightarrow$ oxygen
Droplet moved 1.8 mm per min^{-1} towards the syringe.

The soda lime was removed from the test tube containing the seeds and replaced with an equal volume of glass beads.

$\rightarrow \text{CO}_2$
Droplet moved 1.0 mm in 5 minutes away from syringe.

Each 10 mm of capillary tube has a volume of 8 mm^3 .

- (i) Calculate the **volume** of oxygen consumed.
Show your working.

$\pi r^2 h$

$$\begin{array}{rcl} \boxed{V} & 8 & : \frac{O_2}{x} \\ \boxed{\text{mm}} & 10 & : 1.8 \end{array}$$

$$10x = 8 \times 1.8$$

$$\therefore x = 1.44 \text{ mm}^3 \text{ per min}^{-1}$$

[1]

- (ii) Calculate the **volume** of carbon dioxide produced.
Show your working.

$$\begin{array}{l} 1.0 \text{ mm} = 5 \text{ minute} \\ 0.2 \text{ mm} = 1 \text{ minute} \end{array}$$

$$\begin{array}{rcl} \boxed{V} & 8 & : \frac{\text{CO}_2}{x} \\ \boxed{\text{mm}} & 0.2 & : 1 \end{array}$$

$$x = 0.16 \text{ mm}^3 \text{ per min}^{-1}$$

$$\therefore 0.16 \text{ mm}^3 + 1.44 \text{ mm}^3 = 1.60 \text{ mm}^3 \text{ per min}^{-1}$$

because the seeds absorb oxygen to respire and give out CO_2 .

[3]

- (iii) Calculate the **RQ** of the germinating seed from the data provided.
Show your working.

$$\begin{aligned} \text{RQ} &= \frac{\text{volume of } \text{CO}_2 \text{ given out}}{\text{volume of } \text{O}_2 \text{ taken in}} \\ &= \frac{1.60}{1.44} \\ &= 1.11111 \\ &= 1.11 \text{ or } 1.1 \text{ (1 d.p.)} \end{aligned}$$

[1]

- (c) Explain the advantage of using the apparatus shown in Fig. 1.2, rather than the simpler respirometer that you used in Fig. 1.1.

so that the temperature and pressure in the apparatus can be easily observed and controlled.

[1]

[Total: 10]